

The Impact of Accidental Shocks on Asset Prices from the Perspective of Financial Industry Opening

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How to cite this paper: Li, M., & Zhu, C. (2024). The Impact of Accidental Shocks on Asset Prices from the Perspective of Financial Industry Opening. *Theoretical Economics Letters*, 14, 1455-1477. <https://doi.org/10.4236/tel.2024.144070>

Received: May 3, 2024

Accepted: July 28, 2024

Published: July 31, 2024

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Abstract

This paper introduces open financial intermediaries into a multi-sector dynamic stochastic general equilibrium (DSGE) model of a small open economy, and studies the path and mechanism of the transmission of occasional shocks from one sector to other sectors, including monetary policy shocks, financing cost shocks, foreign capital withdrawal probability shocks, and foreign capital scale shocks, as well as the impact of financial openness and capital procyclical effects on this. The study found that compared with a single price-based monetary policy, the Tobin tax is more effective in cross-border capital flows. Instead of improving cross-border capital flows, a single monetary policy will have an adverse impact on the capital market. When the overseas situation is unstable, it is necessary for the government to use fiscal and monetary means to maintain short-term economic stability and a reasonable structure of household balance sheets. When foreign capital moves on a large scale, the investment structure will change significantly, but in the long run, capital prices will return to a reasonable level after a significant increase.

Keywords

Financial Industry Opening, Accidental Risk Shock, DSGE Model, Asset Prices, China

1. Introduction

As the structural connection between China and the global financial system becomes increasingly stronger, the continued expansion of financial openness will inevitably intensify the spillover and contagion effects of systemic financial risks,

which may threaten national financial security. Therefore, it is of great theoretical value and practical significance to conduct in-depth research on the impact mechanism of external risk factors represented by cross-border capital fluctuations on China's systemic financial risks, build a multi-dimensional and all-round financial risk monitoring and prevention system under high-level financial openness, and firmly keep the bottom line of no systemic financial risks.

With the opening of the global financial industry, financial transactions and investments are no longer restricted by national borders. Expanding the opening of the financial industry will help the financial sector make full use of foreign funds to serve foreign trade and the development of the real economy. However, under the characteristics of high leverage and procyclical capital flows in the financial system, the opening of the financial industry will lead to large-scale two-way capital flows, which may aggravate the volatility of the domestic financial system, trigger systemic risks, and eventually lead to financial crises and even affect the real economy. From the global financial crisis in 2008 to the economic turmoil caused by the new coronavirus epidemic in 2020, all have proved the transmission and impact of financial risks. Therefore, in-depth research on the cross-sector transmission mechanism of risk shocks has become an urgent problem for financial scholars and policymakers. Starting from the perspective of financial industry opening up, this paper extends the [Gertler and Karadi \(2011\)](#) model to the multi-sector model of the open economy, analyzes the impact of financial industry opening up on the cross-sector transmission of risk shocks and the cross-border transmission of external risks, and attempts to explain how to identify and manage these risks in the global financial environment by constructing a comprehensive theoretical framework, and analyzes the specific path of economic fluctuations from one real sector to other real sectors under the background of financial industry opening up.

Compared with previous studies, the marginal contribution of this paper is mainly reflected in the following points:

First, regarding how financial openness affects a country's macroeconomic fluctuations, previous studies have focused more on the currency mismatches presented by corporate balance sheets in an open economy, and less on the openness of the financial system. This paper starts with the balance sheet of banks to study the impact of financial openness on macroeconomic fluctuations, which has important practical significance in the context of China's accelerated financial openness, and provides a basic analytical framework for subsequent related research on financial openness.

Secondly, this paper analyzes the paths and mechanisms of cross-sector and cross-border transmission of risk shocks under the opening of the financial industry. Existing theoretical literature either discusses the cross-sector transmission of risk shocks in the framework of a closed economy, or analyzes the transmission of external risk shocks in a single-sector open economy while ignoring the transmission of risks between sectors. This paper integrates these two

types of literature and clarifies the paths and mechanisms of cross-sector and cross-border transmission of risk shocks under the background of financial industry opening under a unified general equilibrium framework. Therefore, it has certain theoretical innovations and provides a more comprehensive analytical framework for subsequent related policy analysis.

2. Literature Review

Most of the existing studies on the cross-sector transmission of risk shocks have been discussed in a closed economy framework using a multi-sector model. The closed economy framework of multi-sector risk shock transmission is mainly based on macroeconomic theory and analyzes the transmission mechanism of risk shocks between sectors based on economic factors such as aggregate demand, aggregate supply, and price stability. The main researchers include [Acemoglu et al. \(2012\)](#), who built a theoretical model to reveal how the interaction between different economic sectors leads to the macro diffusion of micro shocks. However, these studies on multi-sector models, especially in a closed economy environment, still have a large research gap in the transmission of risk shocks across borders ([Cong & Chen, 2018](#)). This is mainly because the closed economy model cannot fully capture the complex impacts of globalization, such as international trade, production decisions of multinational corporations, and international capital flows ([Guerrieri et al., 2020](#)). Further research has begun to try to introduce the perspective of an open economy. For example, [Bems and Johnson \(2012\)](#) introduced the perspective of international trade and examined how risk shocks are transmitted through international supply chains. However, these studies remain at the micro level of open economy models and have not formed a comprehensive cross-sector transmission model ([Ghosh et al., 2019](#)). Some more recent studies have begun to consider the role of global financial markets in the cross-sector transmission of risk shocks. These studies believe that fluctuations in financial markets will directly affect the investment, production and employment decisions of various economic sectors, thereby leading to the transmission of risk shocks ([Bruno & Shin, 2015](#); [Rey, 2015](#)). This kind of research provides a new perspective for understanding the cross-border transmission of risk shocks, but it also faces the challenge of how to accurately measure these transmission effects in empirical analysis.

In the study of the cross-sector transmission of risk shocks, the limitations of existing research methods and the theoretical models adopted have also begun to attract the attention of scholars. For example, [Ambler et al. \(2002\)](#) proposed that although the multi-sector model has its advantages in theory, in practical applications, due to the lack of detailed inter-sector transaction data, this model often cannot accurately capture the specific transmission path of risk shocks. In addition, the multi-sector model also often ignores the heterogeneity within different sectors, such as the business strategies and risk tolerance of different enterprises. Although the research under the closed economic framework provides us with a

certain perspective to understand how risk shocks are transmitted between different sectors, this perspective ignores the interdependence of the global economy. This interdependence is not limited to trade, but also includes financial markets, technology diffusion, environmental impacts and other aspects (Krugman, 1991; Obstfeld & Rogoff, 1996). Some new studies attempt to further deepen the understanding of the cross-sector transmission mechanism of risk shocks by constructing more complex multi-sector models or introducing new analytical tools such as network theory. For example, Gabaix (2009) proposed a network-based macroeconomic model to analyze how the links between different sectors affect the stability of the economy. However, this new model and method is still in the development stage, and its actual impact on the transmission of risk shocks across sectors still needs further empirical research to confirm.

In general, the study of cross-sector transmission of risk shocks has made some important progress, but there are still many unresolved issues in theory, method and empirical analysis. For example, during a crisis, an adverse shock in a certain real sector is quickly transmitted to other real sectors through the financial sector, thus turning a local risk shock into an overall economic crisis. What is the transmission mechanism? How do the degree of financial openness and the procyclicality of capital flows affect the cross-sector transmission of risks? Will the opening of the financial industry amplify the cross-sector transmission of risks in the state-owned sector, causing this local risk shock to evolve from point to surface and eventually into a major systemic risk?

Solving these problems will help us better understand the transmission mechanism of economic risks, thereby providing stronger theoretical support for the formulation of effective economic policies. Therefore, this paper introduces the opening of financial intermediaries under the open economy multi-sector DSGE framework including financial intermediaries, and discusses the impact of financial industry opening on cross-sector and cross-border contagion of risk shocks and the prevention of systemic financial risks under financial industry opening.

3. Methodology and Model Construction

Referring to the classic literature such as Bernanke et al. (1999), Christiano et al. (2010), Iacoviello (2015) and Aoki (2021), this paper constructs a multi-sector macroeconomic model under an open economy. The model in this paper mainly includes the household sector, the corporate sector, entrepreneurs, the financial intermediary sector, capital goods producers, the government and the international sector. The household sector consumes final goods, provides labor to manufacturers, and can purchase domestic and international financial assets. In these two forms, it provides funds to the financial intermediary sector and obtains asset returns. The corporate sector can be divided into intermediate product production enterprises and final product production enterprises. Intermedi-

ate product production enterprises rent capital and resident labor to produce differentiated intermediate products, and final product production enterprises convert intermediate products into final products for sale. Based on the perspective of capital openness, entrepreneurs are further subdivided into domestic entrepreneurs and foreign entrepreneurs, and the financial intermediary sector is further subdivided into traditional commercial banks and foreign capital. Both domestic and foreign entrepreneurs consume final products, rent capital to intermediate manufacturers and collect rent for capital accumulation, but the difference is that foreign entrepreneurs cannot obtain mortgage loans from traditional commercial banks and can only use foreign capital to invest in foreign-funded enterprises. The capital used by foreign-funded enterprises comes from foreign entrepreneurs, and its operating characteristics are like Tesla China. Traditional commercial banks absorb household savings as operating funds, pay deposit reserves to the central bank, issue mortgage loans to households and enterprises, and pursue profit maximization under the constraints of capital adequacy ratio. Foreign capital can sell equity certificates to the household sector and pursue profit maximization under the constraints of the State Administration of Foreign Exchange.

3.1. Family

Assume that there are many permanent households pursuing utility maximization in economic life. Whether entrepreneurs or bankers are family members, all enterprises and banks are ultimately owned by the household sector. The household sector consumes domestically produced goods C_{dt} and imported goods C_{ft} . The total consumption of the household sector C_t is defined as the following CES function form:

$$C_t = \left[\alpha_f^{\frac{1}{\eta}} (C_{ft})^{\frac{\eta-1}{\eta}} + (1-\alpha_f)^{\frac{1}{\eta}} (C_{dt})^{\frac{\eta-1}{\eta}} \right]^{\frac{\eta}{\eta-1}}$$

The utility function of a representative household is as follows:

$$E_t \left\{ \sum_{t=0}^{\infty} \beta^t \left[\log(C_t - bC_{t-1}) - \psi_L \frac{h_{j,t}^{1+\sigma_L}}{1+\sigma_L} \right] \right\}$$

Among them, C_t is the consumption of representative household j in period t , and $h_{j,t}$ is the labor hours provided by representative household j in period t . Parameter $b > 0$ is used to measure the continuity of consumption pattern habits; $\sigma_L > 0$ indicates the negative utility of labor, which is equal to the inverse of the Frisch elasticity of labor supply; $\psi_L > 0$ is a preference parameter that affects the negative effect of labor supply.

This paper assumes that the representative household j can either deposit its funds in a bank or use them to purchase international assets issued by foreign countries in its own country; the former can obtain risk-free interest income, while the latter has higher income but also bears greater risks. The risk of

household sector investment in international assets mainly comes from the heterogeneous shocks encountered by the capital returns of foreign entrepreneurs in each period. The budget constraint faced by the representative household j in each period is

$$\begin{aligned} P_t C_t + D_t + L_t^{f,h} S_t + T_t + W_t^e \\ = (1 + r_t^{h,f})(1 - \phi_t) L_{t-1}^{f,h} S_t + (1 + r_t^d) D_{t-1} + W_{j,t} h_{j,t} + (1 - \gamma^d)(1 - \eta) V_t^{d,s} \\ + (1 - \gamma^d) \eta V_t^{f,r} + \Pi_t^{IGF} + \Pi_t^{cb} + \Pi_t^f + NCS_{j,t} \end{aligned}$$

The equation is the expenditure item: $P_t C_t$ is the nominal value of current consumption, D_t is the domestic financial assets held by the household sector, $L_t^{f,h} S_t$ is the international financial assets held by the household sector, T_t is the income tax paid by the household sector in the current period, and W_t^e is the transfer payment from the household sector to the entrepreneurial sector. The right side of the equation is the income item of the household sector: the investment return obtained by the household sector in the previous period for the purchase of foreign asset equity products in period t $(1 + r_t^{h,f})(1 - \phi_t) L_{t-1}^{f,h}$, where $r_t^{h,f}$ is the investment rate of return agreed between the household sector and foreign capital, referring to the setting of Schmitt-Grohé & Uribe (2003), that is, the actual interest rate of foreign assets held by the household depends on the base interest rate in the international market and the interest rate premium that changes with the total amount of foreign assets held by the household, ϕ_t is the probability of foreign capital defaulting in period $t - 1$ based on risk considerations, $L_{t-1}^{f,h}$ is the amount of foreign asset equity products purchased by the household sector, which also shows that the rate of return on foreign asset equity products in the non-default state is higher than the risk-free rate of bank savings, otherwise the household is unwilling to bear corporate risk and exchange rate risk and will invest in risk-free bank savings, S_t which is the nominal exchange rate expressed by the direct quotation method. $(1 + r_t^d) D_{t-1}$ is the return on savings of the household sector in commercial banks each period. $W_{j,t} h_{j,t}$ is labor income, $W_{j,t}$ and is the wage level of the representative household j . $(1 - \gamma^d)(1 - \eta) V_t^{d,s}$ and $(1 - \gamma^d) \eta V_t^{f,r}$ represent the wealth transfer from domestic enterprises and foreign-funded enterprises that exit the economy at the end of each period to the household sector. Π_t^{IGF} , Π_t^{cb} , represent Π_t^f the profits of $NCS_{j,t}$ intermediate product production enterprises, banks and foreign capital remaining in the country, and are the state securities held by the representative household j to offset the wage income difference. In order to make the model more realistic, this paper refines the labor income of the household sector and assumes that wages are sticky, that is, ξ_w a proportion of households cannot readjust their wage levels in each period. These households adjust their wage levels according to the inflation rate. That is $W_{j,t} = W_{j,t-1} \bar{\pi}^{l_w} \pi_{t-1}^{1-l_w}$, considering that $1 - \xi_w$ a proportion of households can readjust their wage levels, W_t the dynamic process of is:

$$W_t = \left[\xi_W \left(W_{j,t-1} \bar{\pi}^{l_w} \pi_{t-1}^{1-l_w} \right)^{\frac{1}{1-\lambda_W}} + (1-\xi_W) W_{j,t-1}^{\frac{1}{1-\lambda_W}} \right]^{1-\lambda_W}$$

3.2. Manufacturer

3.2.1. Retailers

Assume that there is a perfectly competitive retailer market in economic life. Retailers use processing technology to process intermediate products into undifferentiated final products, and then distribute the goods to domestic and foreign consumers. When the market is in equilibrium, the profit maximization is solved to obtain the demand function of the intermediate products and the price equation of the final products.

$$Y_t = \left[\alpha_f^\eta (Y_{ft})^{\frac{\eta-1}{\eta}} + (1-\alpha_f)^\eta (Y_{dt})^{\frac{\eta-1}{\eta}} \right]^{\frac{\eta}{\eta-1}}$$

$$Y_{ft} = \alpha_f \left(\frac{P_{ft}}{P_t} \right)^{-\eta} Y_t$$

$$Y_{dt} = (1-\alpha_f) \left(\frac{P_{dt}}{P_t} \right)^{-\eta} Y_t$$

$$P_t = \left[\alpha_f (P_{ft})^{\eta-1} + (1-\alpha_f) (P_{dt})^{\eta-1} \right]^{\frac{1}{\eta-1}}$$

$$Y_t = \left(\int_0^1 Y_{i,t}^{\lambda_f} di \right)^{\frac{1}{\lambda_f}}$$

$$Y_{i,t} = \left(\frac{P_{i,t}}{P_t} \right)^{\frac{\lambda_f}{1-\lambda_f}} Y_t$$

$$P_t = \left(\int_0^1 P_{i,t}^{\frac{1}{1-\lambda_f}} di \right)^{1-\lambda_f}$$

Among them, Y_t^d is the domestic sales of goods. Y_t^f is the export of foreign goods. α_f is the share of export products in the output of final products. $Y_{i,t}$ is the input of the i th intermediate product in the production of the final product. $1 \leq \lambda_f \leq \infty$ is the markup of the intermediate product manufacturers. P_t is the price of the final product, and $P_{i,t}$ is the price of the i th intermediate product. The sale of final products needs to be considered not only from the supply side but also from the demand side.

3.2.2. Intermediate Product Manufacturers

Assume that there is a monopolistic competition in the intermediate product market in economic life, and the intermediate product manufacturers adopt the Cobb-Douglas production function to produce differentiated intermediate products i , which is a continuum and $i \in (0,1)$

$$Y_{i,t} = A_i K_{i,t}^\alpha L_{i,t}^{1-\alpha}$$

where $Y_{i,t}$ is the output of the producer of intermediate product i . A_i is the technology. For convenience, this paper assumes that technology $A_i \equiv A$. $K_{i,t}$ and $L_{i,t}$ are the capital and labor inputs required for intermediate products i . $0 < \alpha < 1$ is the share of capital in the production function.

In practice, if the physical capital required for the production of intermediate products comes from foreign entrepreneurs and domestic entrepreneurs, the quantities are $K_{i,t}^{f,r}$ and respectively $K_{i,t}^{d,s}$, and the sum condition is

$$K_{i,t} = \left[\eta^{1-\rho} (K_{i,t}^f)^\rho + (1-\eta)^{1-\rho} (K_{i,t}^d)^\rho \right]^{\frac{1}{\rho}}$$

It ρ represents the elasticity of substitution of physical capital provided by two different types of entrepreneurs and η represents the relative size of foreign-invested enterprises.

Under this constraint, the cost minimization solution is obtained as follows:

$$\begin{aligned} S_t &= \frac{\rho}{\rho + \alpha(1-\rho)} \left(\frac{W_t}{1-\alpha} \right)^{\frac{\rho}{\rho + \alpha(1-\rho)}} \left[\frac{\alpha}{r_t^{k,d}} (u_t^{f,r} \bar{K}_t^{f,r})^{\rho-1} \right]^{\frac{\rho}{\rho + \alpha(1-\rho)}} (Y_t)^{\frac{\alpha(1-\rho)}{\rho + \alpha(1-\rho)}} S_t \\ &= \frac{r_t^{k,f}}{\alpha \left(\frac{h_t}{K_t} \right)^{1-\alpha} (u_t^{f,r} \bar{K}_t^{f,r})^{\rho-1} \left[\eta (u_t^{f,r} \bar{K}_t^{f,r})^\rho + (1-\eta) (u_t^{d,s} \bar{K}_t^{d,r})^\rho \right]^{\frac{1}{\rho}}} \end{aligned}$$

Among them, $r_t^{k,d}$ and $r_t^{k,f}$ are the actual capital rental rates of domestic and foreign entrepreneurs respectively, $u_t^{f,r}$ and $u_t^{d,s}$ are the capital utilization levels of foreign and domestic entrepreneurs respectively, $\bar{K}_t^{f,r}$ and $\bar{K}_t^{d,r}$ are the physical capital stocks of foreign and domestic entrepreneurs respectively.

Like the household sector, the price of intermediate products is sticky and follows the Calvo pricing process, that is, a proportion ξ_p of enterprises cannot readjust their intermediate product prices in each period and can only follow the price index pricing rule. Under this condition, the expected nominal profit present value maximization solution can be obtained as follows:

$$\begin{aligned} \frac{K_{p,t}}{F_{p,t}} &= \left[\frac{1 - \xi_p \left(\frac{\pi_t^{1-l_1}}{\pi_t} \right)^{\frac{1}{1-\lambda_f}}}{1 - \xi_p} \right]^{1-\lambda_f} \\ K_{p,t} &= \lambda_{n,t} Y_t \lambda_f S_t + \beta \xi_p \left(\frac{\pi_t^{1-l_1}}{\pi_{t+1}} \right)^{\frac{\lambda_f}{1-\lambda_f}} K_{p,t+1} \\ F_{p,t} &= \lambda_{n,t} Y_t + \beta \xi_p \left(\frac{\pi_t^{1-l_1}}{\pi_{t+1}} \right)^{\frac{\lambda_f}{1-\lambda_f}} F_{p,t+1} \end{aligned}$$

Among them, $\lambda_{n,t}$ is the budget constraint multiplier of the household sector, S_t is the nominal marginal cost of the enterprise, $\beta \in (0,1)$ is the discount factor, λ_f is the markup of intermediate product producers, and $0 \leq l_1 \leq 1$ is the weight of the price index to steady-state inflation.

3.2.3. Capital Goods Producers

Referring to the setting of the standard DSGE model, this paper introduces capital goods producers j , which correspond to the production enterprises that rent capital to j the similar sectors (Gertler & Karadi, 2011; Gertler et al., 2012). Assuming that capital goods producers are a continuum of perfect competition, old capital goods can be converted into new capital goods at a ratio of 1:1, and the conversion of final products into capital goods contains lagged investment, so there will be adjustment costs, so the relationship is as follows

$$\begin{aligned} x'_{K,t} &= x_{K,t} + A(I_t, I_{t-1}) \\ A(I_t, I_{t-1}) &= \left[1 - S\left(\frac{I_t}{I_{t-1}}\right) \right] I_t \\ S\left(\frac{I_t}{I_{t-1}}\right) &= \frac{S''}{2} \left(\frac{I_t}{I_{t-1}} - 1 \right)^2 \end{aligned}$$

where is $x_{K,t}$ the depreciated installation capital purchased by capital goods producers from the entrepreneurial sector, I_t is the investment goods purchased by capital goods producers from final goods producers for the production of capital goods, $A(\cdot)$ represents the technology for converting investment goods into capital goods, and follows the setting of Verona et al. (2017), S'' is the curvature of the investment adjustment equation. Solving the equation under the condition of satisfying both the maximization condition and the market clearing condition yields the following equation:

$$\begin{aligned} \lambda_{n,t} &= \lambda_{n,t} Q_{\bar{k},t} \left[1 - \frac{S''}{2} \left(\frac{I_t}{I_{t-1}} - 1 \right)^2 - S'' \frac{I_t}{I_{t-1}} \left(\frac{I_t}{I_{t-1}} - 1 \right) \right] \\ &\quad + \beta \lambda_{n,t+1} Q_{\bar{k},t} S'' \left(\frac{I_{t+1}}{I_t} \right)^2 \left(\frac{I_{t+1}}{I_t} - 1 \right) \\ \eta \bar{K}_{t+1}^{f,r} + (1-\eta) \bar{K}_{t+1}^{d,r} &= (1-\delta) \left[\eta \bar{K}_t^{f,r} + (1-\eta) \bar{K}_t^{d,r} \right] + \left[1 - \frac{S''}{2} \left(\frac{I_t}{I_{t-1}} - 1 \right)^2 \right] I_t \end{aligned}$$

where $Q_{\bar{k},t}$ is the nominal price of the new capital goods. Since the marginal transformation rates of new and old capital goods are the same, it $Q_{\bar{k},t}$ is also the nominal price of the old capital goods, and δ is the depreciation rate of the capital goods.

3.3. Domestic Entrepreneurs

This paper assumes that domestic entrepreneurs have two aspects in their decision-making: one is to maximize profits, and the other is to minimize financing

costs. The objective function is as follows:

$$\begin{aligned} \Pi_t^{r,s} &= \left[u_t^{d,s} r_t^{k,d} - a(u_t^{d,s}) \right] P_t \bar{K}_t^{d,s} + (1-\delta) Q_{\bar{k},t} \bar{K}_t^{d,s} - Q_{\bar{k},t} \bar{K}_{t+1}^{d,s} \\ &\quad - r_t^{l,cb} \left(Q_{\bar{k},t-1} \bar{K}_t^{d,s} - N_t^{d,s} \right) \\ C_t^{r,s} &= \int_0^1 \left[1 + r_{t+1}^{l,cb}(z) \right] L_t^{d,s}(z) dz \end{aligned}$$

where $r_t^{k,d}$ is the price of physical capital provided by domestic entrepreneurs in period t , P_t represents the price of final products in period t , δ is the capital depreciation rate, $r_t^{l,cb}$ is the interest rate at which domestic entrepreneurs obtain loans from traditional commercial banks, where $L_t^{d,s}$ is the loan balance, equals $Q_{\bar{k},t-1} \bar{K}_t^{d,s} - N_t^{d,s}$.

This paper assumes that domestic entrepreneurs can only obtain financing through traditional commercial banks. Traditional commercial banks are a continuum of monopolistic competition. Representative commercial banks have a certain degree of market manipulation power over loan interest rates, that is, each commercial bank implements differentiated pricing for loan interest rates for domestic entrepreneurs. Therefore, there are the following constraints:

$$L_{t+1}^{d,s} = \left\{ \int_0^1 \left[L_{t+1}^{d,s}(z) \right]^{\frac{\varepsilon_{t+1}^{l,op} - 1}{\varepsilon_{t+1}^{l,op}}} dz \right\}^{\frac{\varepsilon_{t+1}^{l,op}}{\varepsilon_{t+1}^{l,op} - 1}}$$

Among them, the total amount of loans to domestic entrepreneurs satisfies the Dixit-Stiglitz aggregation, $\varepsilon_{t+1}^{l,op} > 1$ which is the time-varying interest rate elasticity of loan demand, and determines the addition of commercial bank loans to the deposit interest rate absorbed.

The optimization problem of domestic entrepreneurs is as follows:

$$\begin{aligned} L_{t+1}^{d,s}(z) &= \left[\frac{1 + r_{t+1}^{l,cb}(z)}{1 + r_{t+1}^{l,cb}} \right]^{1 - \varepsilon_{t+1}^{l,op}} L_{t+1}^{d,s} \\ 1 + r_{t+1}^{l,cb} &= \left\{ \int_0^1 \left[1 + r_{t+1}^{l,cb}(z) \right]^{1 - \varepsilon_{t+1}^{l,op}} dj \right\}^{\frac{1}{1 - \varepsilon_{t+1}^{l,op}}} \end{aligned}$$

3.4. Traditional Commercial Banks

This paper assumes that traditional commercial banks are a continuum. According to different business objects, they can be divided into retail and wholesale departments. The retail departments are in a monopolistic competitive position in their respective markets and have a certain bargaining power over deposit and loan interest rates. The wholesale department is in perfect competition, and its deposit and loan interest rates are completely determined by the market. The goal of both departments is to maximize profits. The retail department can be further divided into the deposit retail department and the loan retail department, and their objective functions are

$$\begin{aligned} & (1+r_{t+1}^D)D_{t+1}(z) - [1+r_{t+1}^d(z)]D_{t+1}(z) \\ & (1+r_{t+1}^{L,cb}(z))L_{t+1}^{d,s}(z) - [1+r_{t+1}^{L,cb}]L_{t+1}^{d,s}(z) \end{aligned}$$

Among them, $r_{t+1}^d(z)$ is the risk-free interest rate, $D_{t+1}(z)$ is the household sector deposit, r_{t+1}^D is the yield on deposits provided to the wholesale sector, $r_{t+1}^{L,cb}$ is the cost of obtaining wholesale loans by the retail sector, and $r_{t+1}^{L,cb}$ is the retail loan interest rate.

Given that r_{t+1}^D , the retail deposit sector $r_{t+1}^d(z)$ maximizes profits through selection, and at the same time, the profit maximization goal of the retail loan sector is affected by the minimization of the financing costs of domestic entrepreneurs, so there are the following constraints.

$$\begin{aligned} D_{t+1}(z) &= \left[\frac{1+r_{t+1}^d(z)}{1+r_{t+1}^D} \right]^{-\varepsilon^d} D_{t+1} \\ L_{t+1}^{d,s}(z) &= \left[\frac{1+r_{t+1}^{L,cb}(z)}{1+r_{t+1}^{L,cb}} \right]^{-\varepsilon_{t+1}^{L,op}} L_{t+1}^d \end{aligned}$$

Among them, ε^d is the deposit interest rate elasticity and $\varepsilon_{t+1}^{L,op}$ is the loan interest rate elasticity.

This paper assumes that the wholesale department of commercial banks not only provides the derivative deposits generated by retail deposits to the retail loan department, but also participates in the operation of foreign capital in China. The wholesale department of commercial banks is in a fully competitive position, and its deposit and loan interest rates are determined by market supply and demand. Due to capital opening, foreign capital flows have greater uncertainty. Therefore, the goal of the wholesale department of commercial banks is to maximize the present value of future cash flows. Its objective function is

$$\begin{aligned} & (1+r_t^{L,cb})L_t^{d,s} - L_{t+1}^{d,s} + (1+r_t^{L,fc})(1-\phi_t)L_t^{fc,cb} - L_{t+1}^{fc,cb} + (1+r^R)D_t - D_{t+1} \\ & + \frac{D_{t+1}}{\nu} - (1+r_t^D)\frac{D_t}{\nu} + \Delta N_{t+1}^{cb} - \frac{k}{2} \left(\frac{N_t^{cb}}{L_t^{d,s} + L_t^{fc,cb} + D_t} - \nu_{cb} \right)^2 N_t^{cb} \end{aligned}$$

Among them, ϕ_t represents the probability of foreign capital recovering its investment, and r^R is the deposit reserve rate of commercial banks deposited in the central bank.

3.5. Foreign Entrepreneurs and Foreign Capital

This paper assumes that foreign entrepreneurs mainly obtain financing from foreign capital. After obtaining loans, foreign entrepreneurs purchase physical capital from capital goods producers and provide physical capital to intermediate goods producers to obtain capital rental income. Foreign entrepreneurs and foreign capital are highly connected. This paper assumes that at the end of period t , foreign entrepreneur r decides the amount of capital goods to be purchased in period $t+1$, and then adjusts the scale of foreign capital introduced according

to its own situation. The contract scale between the two becomes a bridge between the net value of foreign-funded enterprises and the net assets of foreign capital in China.

First, the contract size must maximize the income of foreign entrepreneurs.

$$E_t \left\{ \int_{\bar{\omega}_{t+1}^{f,r}}^{\infty} \omega dF(\omega) (1 + R_{t+1}^{k,f}) Q_{\bar{K},t} \bar{K}_{t+1}^{f,r} - [1 - F(\bar{\omega}_{t+1}^{f,r})] \bar{\omega}_{t+1}^{f,r} (1 + R_{t+1}^{k,f}) Q_{\bar{K},t} \bar{K}_{t+1}^{f,r} \right\}$$

where E_t is the expectation of the random variable $R_{t+1}^{k,f}$,

$\int_{\bar{\omega}_{t+1}^{f,r}}^{\infty} \omega dF(\omega) (1 + R_{t+1}^{k,f}) Q_{\bar{K},t} \bar{K}_{t+1}^{f,r}$ is the expected value of the total income of the foreign-funded entrepreneur under the condition that he can pay the financing cost, $[1 - F(\bar{\omega}_{t+1}^{f,r})] \bar{\omega}_{t+1}^{f,r} (1 + R_{t+1}^{k,f}) Q_{\bar{K},t} \bar{K}_{t+1}^{f,r}$ is the cost paid to the foreign capital by the foreign-funded entrepreneur when he has income, and the difference between the two is the net income of the foreign-funded entrepreneur.

Secondly, the net worth of foreign entrepreneurs can be determined through the size of the contract.

$$N_{t+1}^{f,r} = \gamma^f V_t^{f,r} + W^{e,f,r} - N_t^{f,r} \tau_t$$

$$V_t^{f,r} = (1 + R_{t-1}^{k,f}) Q_{\bar{K},t} \bar{K}_t^{f,r} - \left[1 + r_t^F + \frac{\mu \int_0^{\bar{\omega}_{t+1}^{f,r}} \omega dF(\omega) (1 + R_t^{k,f}) Q_{\bar{K},t-1} \bar{K}_t^{f,r}}{Q_{\bar{K},t-1} \bar{K}_t^{f,r} - N_t^{f,r}} \right] (Q_{\bar{K},t-1} \bar{K}_t^{f,r} - N_t^{f,r})$$

Among them, $1 - \gamma^f$ is the probability of foreign-funded entrepreneurs exiting the domestic economy each period. $W^{e,f,r}$ is the initial transfer payment from the domestic household sector to the surviving and newly entered foreign-funded entrepreneurs in the previous period.

Finally, the dynamic process of foreign capital in China can be determined by the contract size.

$$N_t^{fc} = (1 - \phi_{t-1}) N_{t-1}^{fc} + [1 - F(\bar{\omega}_{t+1}^{f,r})] (1 + r_{t+1}^{fc}) L_{t+1}^{f,r}$$

$$+ (1 - \mu) \int_0^{\bar{\omega}_{t+1}^{f,r}} \omega dF(\omega) (1 + R_t^{k,f}) Q_{\bar{K},t-1} \bar{K}_t^{f,r} - (1 + r_t^F) L_t^{f,r} + w^{fc}$$

Among them, $(1 - \phi_{t-1}) N_{t-1}^{fc}$ is the net value of foreign capital recovered at the end of period $t - 1$,

$$\left\{ [1 - F(\bar{\omega}_{t+1}^{f,r})] (1 + r_{t+1}^{fc}) L_{t+1}^{f,r} + (1 - \mu) \int_0^{\bar{\omega}_{t+1}^{f,r}} \omega dF(\omega) (1 + R_t^{k,f}) Q_{\bar{K},t-1} \bar{K}_t^{f,r} - (1 + r_t^F) L_t^{f,r} \right\}$$

is the investment income of foreign capital in China, and w^{fc} is the wages paid by foreign capital.

3.6. Government

Assume that there is a local government with an investment attraction target in the economy. Each period of foreign capital inflow will be monitored. When the growth rate of foreign investment is lower than the implicit target, the government will increase investment attraction. When the growth rate is too high, it will also print economic activity:

$$G_t = \left[1 - \left(\frac{I_t}{I_{t-1}} - \bar{I}_g \right) \gamma^f \right] \eta_g Y_t$$

where is γ^f the sensitivity of regulatory intention to fluctuations in foreign investment. The constraints are:

$$\begin{aligned} G_t &= T_t \\ T_t &= N_t^{f,r} \tau_t \end{aligned}$$

Of this amount, T_t there is Tobin tax revenue.

3.7. Central Bank

3.7.1. Monetary Policy

Assume that the central bank sets the short-term policy rate according to the Taylor rule with additional interest rate smoothing, that is, the central bank sets the interest rate as a function of the deviations of inflation and output from their steady-state levels:

$$r_t^p = r_{t-1}^p \tilde{\rho} \left[\bar{r}^p \left(\frac{E_t \pi_{t+1}}{\bar{\pi}} \right)^{\alpha_\pi} \left(\frac{Y_t}{\bar{Y}} \right)^{\alpha_y} \right]^{1-\tilde{\rho}} \varepsilon_t^{MP}$$

where r_t^p is the policy interest rate, \bar{r}^p is the steady-state value of the policy interest rate, $\tilde{\rho}$ is the interest rate smoothing coefficient, α_π is the reaction coefficient of the interest rate to inflation, α_y is the reaction coefficient of the interest rate to output, and ε_t^{MP} is the exogenous shock to monetary policy.

3.7.2. Foreign Capital Financing Supervision Policy

Drawing on the approach of Aoki (2021), we consider the following macroprudential tax rules:

$$\tau_t = \omega_D \log \left(\frac{N_t^{fc}}{L_t^f} \right)$$

where ω_D represents countercyclical operations and τ_t is a function of the percentage deviation of assets in cross-border capital formation from the steady state.

4. Market Clearing in an Open Environment

The domestic output level is composed of three parts: domestic consumption, investment, and exports. The clearing equation is

$$Y_t = C_t + I_t + NX_t$$

Domestic Credit Market Clearing Equation

$$D_t + L_t^{d,s} + L_t^{fc,cb} = \frac{D_t}{v} + N_t^{cb}$$

Since net exports are always equal to net capital flows in a capital-open environment, and net capital flows are the net value of foreign capital in China, we

can get the following relationship:

$$NX_t = N_t^{fc}$$

5. Parameter Calibration and Estimation

The parameters in this model are divided into two groups according to their nature. One group of parameters will be directly set according to the existing research literature, and the other group of parameters will be estimated based on actual empirical data to reflect the characteristics of China's economy. The first type of standard parameters includes standard parameters related to the financial sector and the non-financial sector: the financial sector parameters directly correspond to the theoretical assumptions of the model. At the same time, this paper uses the standard framework of [Gertler and Karadi \(2011\)](#), [Gertler et al. \(2012\)](#) and [Aoki \(2021\)](#) on the opening of the financial sector, so some parameters in this part are directly borrowed from these literatures. Since this paper is based on the framework of the standard small country opening model, the standard parameters of the non-financial sector are modified based on the research on the Chinese economy by [Mei and Gong \(2012\)](#), [Funke et al. \(2015\)](#), etc. The second type is the structural parameters that reflect the characteristics of China's economy. For the structural parameters in the model that reflect China's characteristics, this paper calibrates them based on China's macro data such as consumption, investment, government public expenditure and net exports over the years. Finally, for the model-specific parameters that cannot be determined, especially the parameters of various shocks, this paper uses the Bayesian method based on China's macroeconomic data to estimate them.

First, the standard parameters related to the financial sector are based on the literature on the banking sector, such as [Gertler and Karadi \(2011\)](#), [Verona et al. \(2017\)](#), and [Aoki \(2021\)](#). Specifically, consistent with the values of [Aoki \(2021\)](#), this paper sets the bank survival probability to 0.94 and the bank leverage ratio to 6. Referring to the setting of [Verona et al. \(2017\)](#) for the sensitivity of commercial bank risk appetite to corporate net assets, it is α^{cb} set to 40. Other bank parameters can be set accordingly according to the relevant parameters of the banking sector in the steady state.

Secondly, for the standard parameters of the non-financial sector. Referring to [Funke et al. \(2015\)](#), the deposit rate elasticity and loan rate elasticity were calibrated based on China's empirical data, we obtained $\varepsilon_d = -222$, $\varepsilon_l = 389$. Referring to [Xu et al. \(2012\)](#), by matching the regional code, household code and household internal code, the individual samples that reported wage income data for two consecutive years were selected, the logarithm of the individual annual wage was taken and then the difference was made, and then the actual wage change rate was calculated using the annual CPI growth rate announced by the National Bureau of Statistics, and the wage stickiness was obtained ξ_w to be 0.025. Referring to [Wang et al. \(2012\)](#), the estimation results were obtained, and the price stickiness was set ξ_p to 0.248. Referring to [Liu \(2008\)](#), the capital de-

preciation rate was set to $\delta = 0.035$. Referring to the settings of [Christiano et al. \(2010\)](#), the intermediate product price markup λ_f was set to 1.2, the consumption habit parameter b was set to 0.63, the wage markup rate λ_w was set to 1.05, and the curvature of the investment adjustment cost equation S'' was set to 29.3. Refer to [Tong \(2017\)](#) and $1/\sigma_L$ set the Frisch elasticity to 1.

Again, the structural parameter that reflects Chinese characteristics in the model is the β subjective discount value of the household sector. Based on the data provided by the World Bank database, this paper calculates the geometric mean of China's one-year time deposit interest rate from 2000 to 2021 and solves it $\beta = 0.9942$. ν is the statutory deposit reserve ratio of commercial banks. On December 5, 2022, the People's Bank of China lowered the deposit reserve ratio of financial institutions. After this reduction, the weighted average deposit reserve ratio of financial institutions ν is about 7.8%. r^R is the statutory deposit reserve interest rate. The interest rate implemented by the People's Bank of China to pay interest to commercial banks is 0.35% per quarter. According to China's actual situation, the quarterly growth rate of GDP, the quarterly month-on-month change of the consumer price index, and the Shanghai Inter-bank Offered Rate overnight are selected. The processed GDP and consumer price index data are screened by HP filtering. Referring to the model settings, the de-trending process is carried out, assuming that the potential inflation rate is 0.775% and the potential GDP growth rate is the HP-Filtered sequence. A regression equation containing the output gap and the inflation gap is constructed to obtain an interest rate smoothing coefficient $\pi^* \bar{\rho}$ of 0.7078, a monetary policy reaction coefficient to inflation α_π of 0.9913, and a monetary policy reaction coefficient to output fluctuations α_y of 0.2642.

Finally, for model-specific parameters that cannot be determined, especially the parameters of various shocks, this paper uses the Bayesian method to estimate them based on China's macroeconomic data.

6. Pulse Response Analysis

This section will analyze the transmission mechanism of internal and external shocks between domestic sectors and their impact on domestic asset prices through cross-border capital flows based on the high level of financial industry opening up¹. Among them, endogenous shocks include unexpected interest rate policies and the imposition of Tobin taxes, while exogenous shocks include incidental events and cross-border capital fluctuations.

6.1. Unexpected Interest Rate Policy

Unexpected interest rate policy refers to the interest rate policy adopted by the domestic monetary authorities that is contrary to market expectations. In order to study the impact of unexpected interest rate policy on domestic asset prices,

¹Among them, the cross-border capital fluctuations themselves represent cross-border capital flows, so there is no need to affect domestic asset prices through cross-border capital flows.

this paper uses a positive interest rate shock of 1 unit to examine the impact of related variables. The results are shown in **Figure 1**.

This paper takes the contractionary interest rate policy as an example. When the central bank adopts a contractionary monetary policy for regulation, all variables will undergo significant changes, and the balance of the domestic macroeconomic system represented by the interest rates of domestic and foreign loans, the scale of foreign debt held by households and banks, and the capital of foreign institutions will be destroyed. One unit of unexpected positive interest rate policy shock causes the policy interest rate to deviate by 0.27% at the beginning of the period, reaching a peak of 0.3% in the second period, and returning to a steady state after 20 periods. Under the influence of the policy interest rate, the domestic loan rate also has a positive deviation of 0.27% at the beginning of the period, which turns from a positive deviation to a negative deviation after 10 periods, and finally returns to a steady state after 30 periods².

6.2. Unexpected Interest Rate Policy

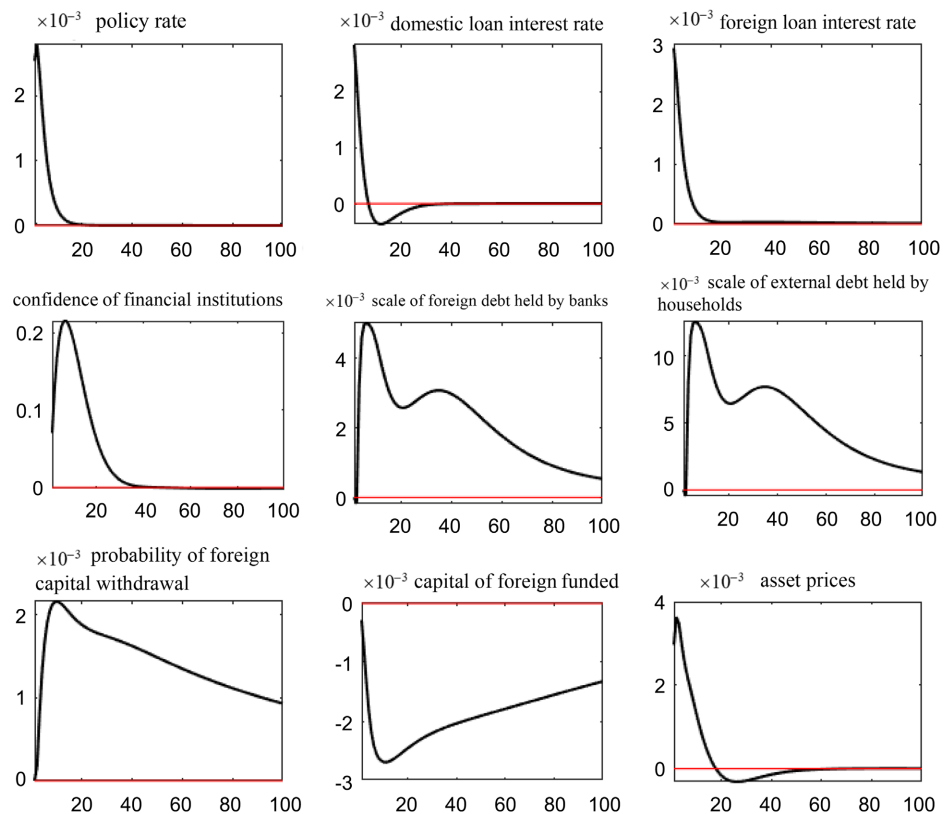


Figure 1. Impulse response results of unexpected interest rate policy.

The Impulse response results of unexpected interest rate policy are in **Figure 1**. The foreign loan interest rate had a deviation of 0.3% at the beginning of the period. Unlike the domestic loan interest rate, the foreign loan interest rate did

²Due to space limitations, the specific results are not reported but will be kept on request.

not show a negative deviation in the entire 100 periods, and the time of returning to steady state was earlier than the time of returning to steady state of the domestic loan interest rate. The policy interest rate affects the confidence of financial institutions to a certain extent. At the beginning of the period, it can be seen that the confidence of financial institutions has a positive deviation of 9%, reaching a peak of 20% in the 10th period, and then reaching a steady state at the same time as the domestic loan interest rate in the 40th period.

Under the influence of the positive deviation of asset yield, the scale of foreign debt held by the banking sector and the scale of foreign debt held by the household sector deviate from the same trend. The only difference is the peak level. The peak of the scale of foreign debt held by the bank is 0.5%, and the peak of the scale of foreign debt held by the household is 1.2%. Under the influence of the scale of foreign debt, the probability of foreign capital withdrawal increases, starting from the steady state at the beginning of the period, reaching a peak of 0.2% in the 15th period. With the decline of the deviation of the scale of foreign debt, the probability of foreign capital withdrawal also gradually decreases, but it has not returned to the steady state within 100 periods. The capital of foreign institutions is highly correlated with the probability of foreign capital withdrawal, with a negative deviation of 0.05% at the beginning of the period and a minimum of -0.27% in the 15th period. The asset price has a positive deviation of 0.3% in the 0th period, reaching a peak of 0.35% in the 1st period, and then turning from positive deviation to negative deviation in the 20th period, reaching the lowest point around the 30th period, and finally returning to the steady state in the 50th period. Its trend change lags behind the domestic loan interest rate.

6.3. Tobin Tax

Tobin tax is a transaction tax levied on foreign exchange transactions, which aims to increase the cost of short-term foreign exchange transactions to curb excessive short-term capital cross-border flows. Therefore, in this article, Tobin tax can be regarded as the financing cost of cross-border capital.

To study the impact of cross-border capital inflow cost shock on the open economy, this paper uses a 1-unit positive financing cost shock to examine the changes in macroeconomic variables. When the regulatory authorities increase the Tobin tax rate, all macroeconomic variables will undergo significant changes, and the balance of the domestic macroeconomic system will be disrupted.

The Impulse response results of Tobin tax are in **Figure 2**. One unit of unexpected positive financing cost shock causes financial institutions to have a downward deviation of 1.5 at the beginning of the period, and the downward deviation reaches a maximum of 3.5 in the fifth period, and returns to a steady state after 35 periods. The decline in the confidence of financial institutions causes the total investment in the economy to deviate downward by 0.03, and returns to a steady state after 80 periods. The decline in total investment has

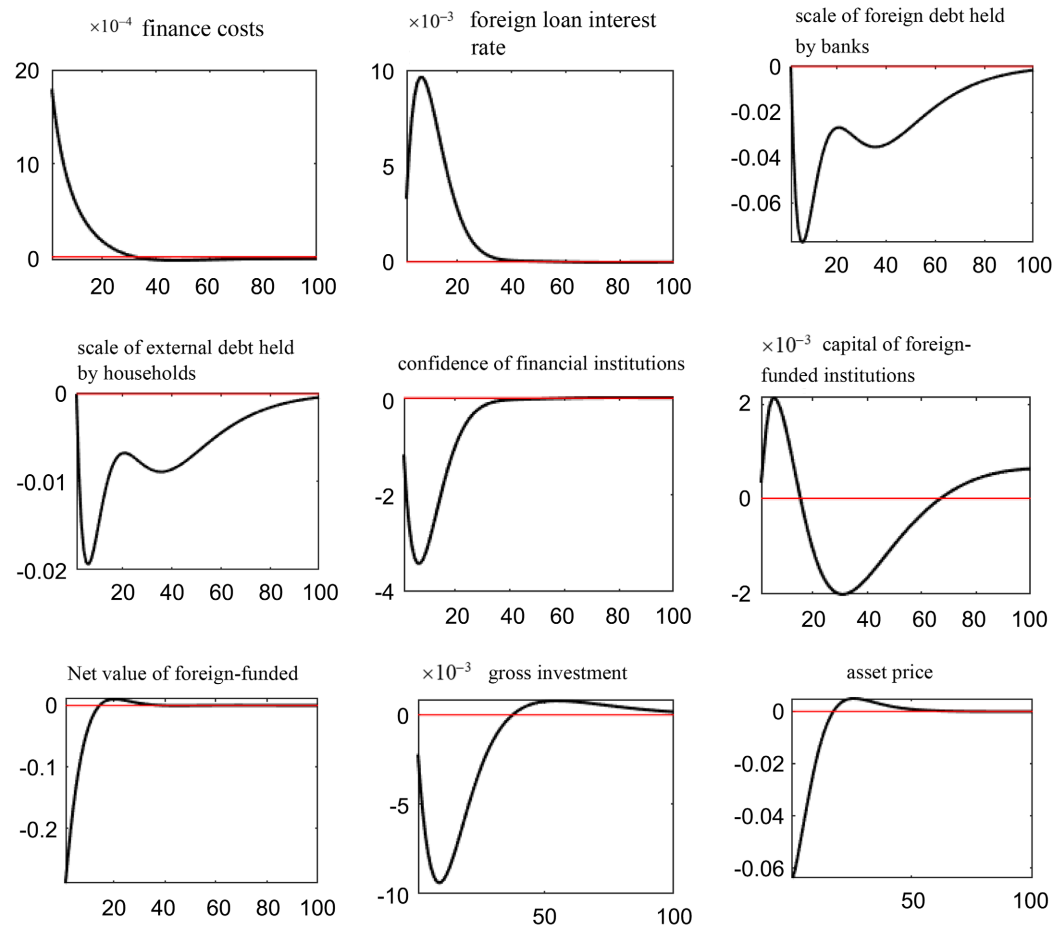


Figure 2. Impulse response results of Tobin tax.

reduced the net value of domestic and foreign-funded enterprises at the macro level, driving down asset prices and reducing asset bubbles. The increase in Tobin tax has reduced the enthusiasm of foreign capital to invest in China to a certain extent. Foreign-funded enterprises will seek funds from financial institutions at higher interest rates and increase capital utilization, but it has no obvious impact on the overall economy, and the inflation rate of the economy has declined in the short term. Domestic enterprises are funded by traditional financial institutions throughout the existence of the economy. After observing the decline in confidence in financial institutions, such enterprises will choose to increase their debt scale to cope with the adverse impact of the decline in total output on welfare. Due to the existence of wage rigidity, in the short term, family life has a short-term increase in total consumption due to the decline in inflation rate, but after 20 periods, wages have deviated downward, and total consumption has also deviated downward. The actual reason may be that the increase in cross-border financing costs means that enterprises need more funds to maintain existing operations or expand their businesses, which may cause enterprises to cut production and reduce costs.

6.4. Probability of Foreign Capital Withdrawal

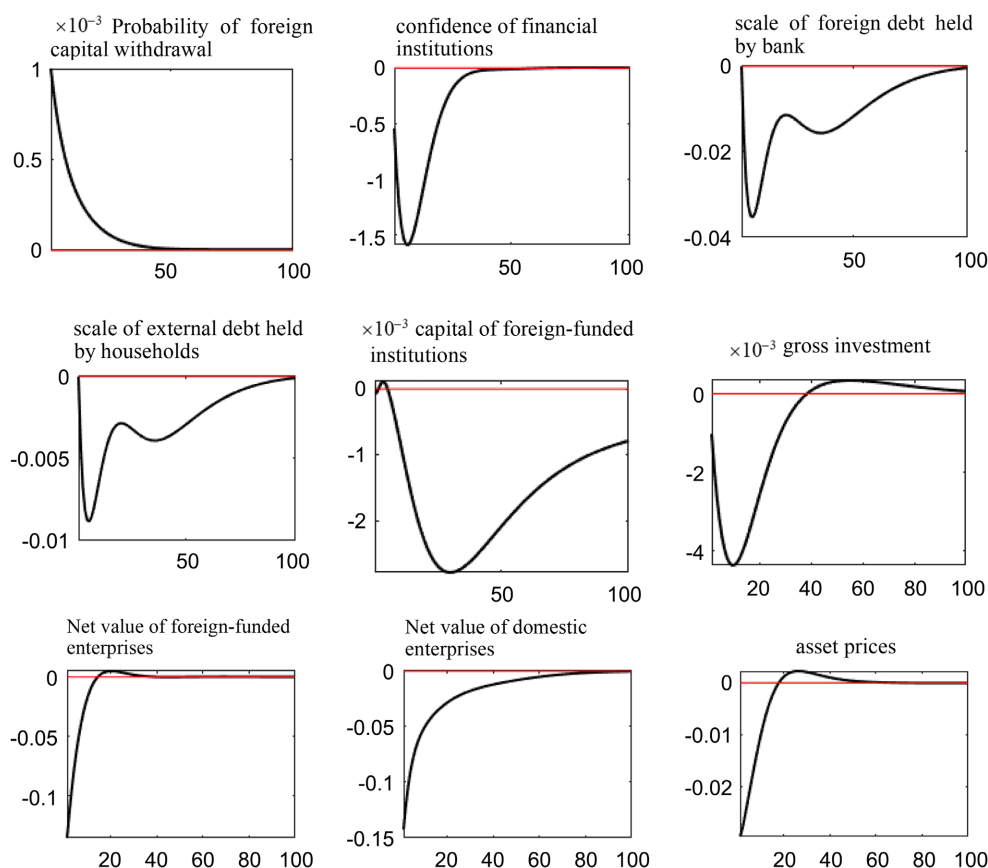


Figure 3. Impulse response results of Probability of foreign capital withdrawal.

Impulse response results of Probability of foreign capital withdrawal are in **Figure 3**. To study the impact of the probability of capital withdrawal on the open economy, this paper uses a positive probability of capital withdrawal shock of 1 unit to examine the changes in economic and financial variables. The consequences of this shock are similar to those of the financing cost shock. The biggest difference is that although the capital adequacy ratio has a positive deviation, the capital has been in a state of flight. The domestic financing cost shock is an endogenous factor that the country can independently regulate, while the probability of foreign capital withdrawal shock can be an exogenous factor. When a one-unit shock is applied to the probability of capital withdrawal of foreign financial institutions, the probability of foreign capital withdrawal will directly increase. Since capital is sensitive, traditional domestic financial institutions will recognize this signal and identify it as a decline in foreign capital's confidence in the domestic economy or other markets with higher returns or lower risks. Traditional domestic financial institutions will also follow the footsteps of foreign capital to reconfigure assets. The increase in the probability of foreign capital withdrawal will also cause the household sector to consciously

reduce the proportion of foreign capital bonds when allocating assets. When domestic financial institutions and households reduce foreign debt allocation, foreign financial institutions will take the initiative to increase capital to maintain basic policy requirements. After the proportion of liabilities decreases, they will gradually reduce capital in China, resulting in capital outflow. In addition, the decline in the confidence of financial institutions will also lead to a decline in the investment of both domestic and foreign-funded enterprises. This is directly reflected in the decline in the net value of domestic and foreign-funded enterprises, which ultimately leads to a decline in asset prices. The increase in the net value of foreign-funded enterprises in the later period is mainly due to the government's requirements for the proportion of investment promotion, and foreign-funded enterprises can produce in their own country under more favorable conditions. The stability of the net value of foreign-funded enterprises has led to a decrease in the probability of foreign capital withdrawal, and the total investment in the country has also increased. The confidence of financial institutions has returned to a steady state, and asset prices have also returned to a steady state after fluctuations.

6.5. Impact of Foreign Capital Scale

To study the impact of financing scale shock on the open economy (this shock and the divestment probability shock are both external shocks to the economy), this paper uses 1 unit of positive and negative financing scale shocks to examine the changes in economic and financial variables.

When the scale of foreign capital inflow into China increases, it is a positive shock, and all macroeconomic variables will undergo significant changes, and the balance of the domestic macroeconomic system will be disrupted. The increase in the scale of foreign capital inflow into China directly reflects the increase in the confidence of foreign financial institutions in domestic investment, which drives the increase in total investment and total output.

The impulse response results of impact of foreign capital scale are in **Figure 4**. Since excessive overseas funds need to be exchanged, the central bank maintains exchange rate stability and conducts monetary operations, which leads to an increase in liquidity in the market and an increase in inflation. This leads to a decline in the actual wage level of households, which in turn leads to a decline in total consumption. However, the increase in corporate net worth driven by total investment, under the effect of downward wage rigidity, makes households demand higher wage levels, which also reflects the upward deviation of total consumption after 20 periods. The increase in corporate net worth drives up asset prices and may lead to asset bubbles. However, after 20 periods, asset prices fell. The actual reason may be the difference in behavior between domestic and foreign investors. Foreign investors may have different risk exposure and holding periods for domestic assets. Unlike domestic investors, if the previous investment behavior of foreign capital is not physical investment but short-term or

speculative investment, it may be easier to flow out when better investment opportunities appear in other markets, which may put pressure on asset prices.

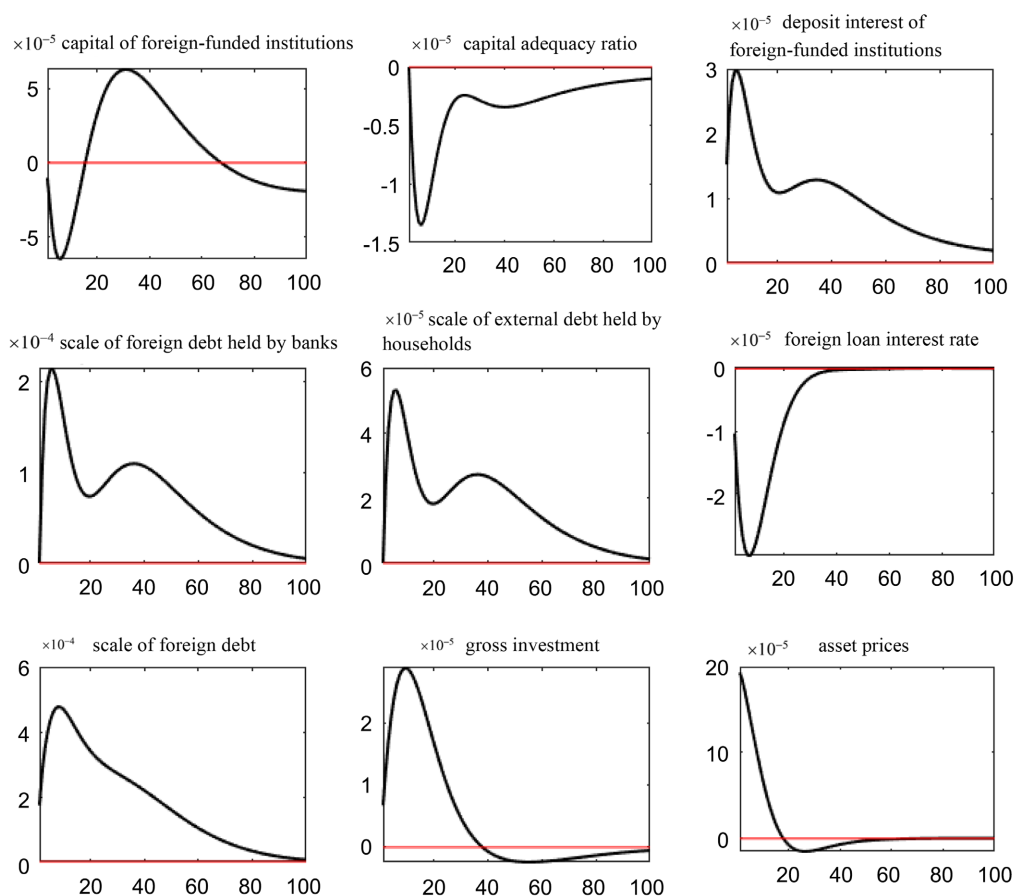


Figure 4. Impulse response results of impact of foreign capital scale.

7. Conclusion

This paper introduces open financial intermediaries into the multi-sector dynamic stochastic general equilibrium (DSGE) model of a small country's open economy, and studies the path and mechanism of the transmission of occasional shocks from one sector to another sector, including monetary policy shocks, financing cost shocks, foreign capital withdrawal probability shocks, and foreign capital scale shocks, as well as the impact of financial openness and capital pro-cyclical effects on this. The study found that when China imposes restrictions on cross-border capital, it will indeed have a greater negative impact on the overall situation in the short term, but in the long run, Tobin tax is more effective than a single price-based monetary policy. At the same time, a single monetary policy cannot improve the cross-border capital flow situation, but will have an adverse impact on the capital market, and needs to be supplemented by corresponding foreign exchange policies. Due to the high resilience of China's economy, when China faces an unstable overseas situation, it can enhance foreign investment

confidence in the long run, but it needs to be supplemented by necessary fiscal and monetary means to maintain short-term economic stability and make the household balance sheet structure tend to a reasonable level. When China does experience changes in the scale of foreign capital in China, the investment structure will change significantly, further affecting capital prices, but after capital repatriation, long-term capital prices will return to a reasonable level.

Funding

This work was supported by the “China’s National Philosophy and Social Science Fund” under Grant “23CJY040”.

Conflicts of Interest

No potential conflict of interest was reported by the authors.

References

- Acemoglu, D., Carvalho, V. M., Ozdaglar, A., & Tahbaz-Salehi, A. (2012). The Network Origins of Aggregate Fluctuations. *Econometrica*, *80*, 1977-2016.
- Ambler, S., Cardia, E., & Zimmermann, C. (2002). International Transmission of the Business Cycle in a Multi-Sector Model. *European Economic Review*, *46*, 273-300. [https://doi.org/10.1016/S0014-2921\(01\)00098-8](https://doi.org/10.1016/S0014-2921(01)00098-8)
- Aoki, Y. (2021). The Effect of Bank Relationships on Bond Spreads: Additional Evidence from Japan. *Journal of Corporate Finance*, *68*, Article ID: 101937. <https://doi.org/10.1016/j.jcorpfin.2021.101937>
- Armano, M., Audley, H., Auger, G., Baird, J. T., Binetruy, P., Born, M. et al. (2017). Charge-Induced Force Noise on Free-Falling Test Masses: Results from LISA Pathfinder. *Physical Review Letters*, *118*, Article ID: 171101. <https://doi.org/10.1103/physrevlett.118.171101>
- Bems, R., & Johnson, R. C. (2012). *Value-Added Exchange Rates (No. w18498)*. National Bureau of Economic Research.
- Bernanke, B. S., Gertler, M., & Gilchrist, S. (1999). Chapter 21 the Financial Accelerator in a Quantitative Business Cycle Framework. *Handbook of Macroeconomics*, *1*, 1341-1393. [https://doi.org/10.1016/s1574-0048\(99\)10034-x](https://doi.org/10.1016/s1574-0048(99)10034-x)
- Bruno, V., & Shin, H. S. (2015). Capital Flows and the Risk-Taking Channel of Monetary Policy. *Journal of Monetary Economics*, *71*, 119-132. <https://doi.org/10.1016/j.jmoneco.2014.11.011>
- Christiano, L. J., Motto, R., & Rostagno, M. (2010). Financial Factors in Economic Fluctuations. *SSRN Electronic Journal*. <https://doi.org/10.2139/ssrn.1600166>
- Cong, H., & Chen, Y. (2018). Effect of Confidence Shock on an Economy with a Shadow Banking System: Analysis Based on Dynamic Stochastic General Equilibrium Model. *Theoretical Economics Letters*, *8*, 3285-3300. <https://doi.org/10.4236/tel.2018.815203>
- Funke, M., Shu, C., Cheng, X., & Eraslan, S. (2015). Assessing the CNH-CNY Pricing Differential: Role of Fundamentals, Contagion and Policy. *Journal of International Money and Finance*, *59*, 245-262. <https://doi.org/10.1016/j.jimonfin.2015.07.008>
- Gabaix, X. (2009). Power Laws in Economics and Finance. *Annual Review of Economics*, *1*, 255-294. <https://doi.org/10.1146/annurev.economics.050708.142940>

- Gertler, M., & Karadi, P. (2011). A Model of Unconventional Monetary Policy. *Journal of Monetary Economics*, 58, 17-34. <https://doi.org/10.1016/j.jmoneco.2010.10.004>
- Gertler, P. J., Martinez, S. W., & Rubio-Codina, M. (2012). Investing Cash Transfers to Raise Long-Term Living Standards. *American Economic Journal: Applied Economics*, 4, 164-192. <https://doi.org/10.1257/app.4.1.164>
- Ghosh, S., Gopalakrishnan, P., & Satija, S. (2020). Recapitalization in an Economy with State-Owned Banks—A DSGE Framework. *Theoretical Economics Letters*, 10, 232-249. <https://doi.org/10.4236/tel.2020.101015>
- Guerrieri, V., Lorenzoni, G., Straub, L., & Werning, I. (2022). Macroeconomic Implications of COVID-19: Can Negative Supply Shocks Cause Demand Shortages? *American Economic Review*, 112, 1437-1474. <https://doi.org/10.1257/aer.20201063>
- Iacoviello, M. (2015). Financial Business Cycles. *Review of Economic Dynamics*, 18, 140-163. <https://doi.org/10.1016/j.red.2014.09.003>
- Krugman, P. (1991). Increasing Returns and Economic Geography. *Journal of Political Economy*, 99, 483-499. <https://doi.org/10.1086/261763>
- Liu, B. (2008). Development of My Country's DSGE Model and Its Application in Monetary Policy Analysis. *Financial Research*, No. 10, 1-21.
- Mei, D. Z., & Gong, L. T. (2012). Welfare Loss of Current Account Adjustment: An Analysis Based on a Two-Country Model. *Management World*, No. 4, 33-46, 187.
- Obstfeld, M., & Rogoff, K. (1996). *Foundations of International Macroeconomics*. MIT Press.
- Rey, H. (2015). *Dilemma Not Trilemma: The Global Financial Cycle and Monetary Policy Independence* (No. w21162). National Bureau of Economic Research.
- Schmitt-Grohé, S., & Uribe, M. (2003). Closing Small Open Economy Models. *Journal of International Economics*, 61, 163-185. [https://doi.org/10.1016/S0022-1996\(02\)00056-9](https://doi.org/10.1016/S0022-1996(02)00056-9)
- Tong, B. (2017). Mixed Frequency Data, Investment Shocks and China's Macroeconomic Fluctuations. *Economic Research*, No. 6, 60-76.
- Verona, F., Martins, M. M. F., & Drumond, I. (2017). Financial Shocks, Financial Stability, and Optimal Taylor Rules. *Journal of Macroeconomics*, 54, 187-207. <https://doi.org/10.1016/j.jmacro.2017.04.004>
- Wang, L. Y., Zhang, L. G., & Liu, W. G. (2012). An Empirical Study on the Financial Accelerator Effect under Different Viscosity Conditions. *Economic Research*, No. 10, 69-81, 160.
- Xu, J. W., Ji, Y., & Chen, B. K. (2012). Estimation of the Stickiness of Nominal Wages in China's Labor Market. *Economic Research*, No. 4, 64-76.